



US006324639B1

(12) **United States Patent**  
Heishi et al.

(10) Patent No.: **US 6,324,639 B1**  
(45) Date of Patent: **Nov. 27, 2001**

(54) **INSTRUCTION CONVERTING APPARATUS  
USING PARALLEL EXECUTION CODE**

(56) **References Cited**

(75) Inventors: **Taketo Heishi, Osaka; Tetsuya  
Tanaka, Ibaraki; Nobuo Higaki, Osaka;  
Shuishi Takayama, Takarazuka;  
Kensuke Odani, Kyoto, all of (JP)**

**U.S. PATENT DOCUMENTS**

3,955,180 • 5/1976 Hirtle ..... 703/26  
4,611,281 • 9/1986 Suko et al. .... 714/39  
4,858,105 • 8/1989 Kuriyama et al. .... 712/235  
5,452,461 • 9/1995 Umekita et al. .... 717/6

(73) Assignee: **Matsushita Electric Industrial Co.,  
Ltd., Osaka (JP)**

\* cited by examiner

(\*) Notice: Subject to any disclaimer, the term of this  
patent is extended or adjusted under 35  
U.S.C. 154(b) by 0 days.

*Primary Examiner*—Daniel H. Pan  
(74) *Attorney, Agent, or Firm*—Price and Gess

(21) Appl. No.: **09/280,777**

(22) Filed: **Mar. 29, 1999**

(30) **Foreign Application Priority Data**

Mar. 30, 1998 (JP) ..... 10-083368  
Apr. 8, 1998 (JP) ..... 10-095647

(51) Int. Cl.<sup>7</sup> ..... **G06F 9/38; G06F 9/30;  
G06F 9/44**

(52) U.S. Cl. .... **712/212; 712/245; 712/206;  
712/215; 712/23**

(58) Field of Search ..... **712/206, 215,  
712/205, 245, 201, 208, 212, 209, 217,  
23, 219, 235, 213, 207; 703/22, 23, 24,  
25, 26, 27, 28; 717/6, 10, 7; 714/39**

(57) **ABSTRACT**

A processor can decode short instructions with a word length equal to one unit field and long instructions with a word length equal to two unit fields. An opcode of each kind of instruction is arranged into the first unit field assigned to the instruction. The number of instructions to be executed by the processor in parallel is *s*. When the ratio of short to long instructions is *s*-1:1, the *s*-1 short instructions are assigned to the first unit field to the *s*-1<sup>st</sup> unit field in the parallel execution code, and the long instruction is assigned to the *s*<sup>th</sup> unit field to the (*s*+*k*-1)<sup>th</sup> unit field in the same parallel execution code.

**33 Claims, 29 Drawing Sheets**

